COST COMPARISON OF CONVENIENT FRAME WITH SHEAR WALL-FLAT SLAB SYSTEM

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ABSTRACT

Structure Optimisation Has Become A Main Task In A Civil Engineering Project. As A Matter Of Fact, Due To The Complexity And Particularity Of Every Structure, The Great Amount Of Variables And Design Criteria To Considerate And Many Other Factors, A General Optimisation's Method Is Not Simple To Formulate. The Optimization Method Is Based On Decomposition Of The Main Structure Into Substructures: Floor System, Vertical Load Resisting System, Lateral Load Resisting System And Foundation System.

KEYWORDS: Shear Wall – Flat Slab System, Cost Comparison, Cost Optimsation.

1. INTRODUCTION:

The Economic Cost Of A Structure Is Clearly Of Great Priority In A Project, Structure Design Is A Simple Task. Nevertheless, For A Same Building There Are Different Possible Structure Layouts. This Research Focuses Solely On The Cost Comparison Of High-Rise Residential Reinforced Concrete Buildings. The Particularities Of Such Structures Are Shear-Wall Structure As Lateral Load And Vertical Load Resisting System, With Flat Slab As Gravitational Floor System And A Raft And Driven Piles As Deep Foundation System.

2. MATERIALS AND METHODS:

A. Structural Design Approach: The Structural Analysis Is Carried Out To The Relevant Indian Standards Using In-House Developed Spreadsheets And Propriety Etabs Structural Software. Care Is Taken To Ensure That For The Housing Blocks Which Are Asymmetrical In Plan, Both Static And Dynamic Analysis Is Undertaken And Tallied.

Where Stilt Parking Is Required, The Shear Wall Portal Fames Are Converted Into Moment Resisting Portal Frames In One Direction And The Cross Shear Walls In Other Direction Have Been Provided At Plinth Level To Avoid "Soft Storey" Effects. Main Foundations Of All Buildings Shall Be Taken Up To The Depth Of Minimum 2.4m As Required Moisture Content Does Not Change At This Level And Also For Minimum Safe Bearing Capacity Of 200 Kn/M2.

B. Reinforcement Requirements: Minimum Reinforcement And Spacing Requirements As Defined In IS 456:2000 Would Be Adopted To Control Shrinkage And Temperature Stresses. These Ratios Are Reproduced Below

Structural Member	Minimum reinforcement ratio (as % of Ag)	Governing Clause	Remarks
Beams	(0.85/fy)%	26.5.1.1	-
Slabs	0.12%	26.5.2.1	-
Columns	0.80%	26.5.3.1	-
Walls - Horizontal Reinforcement	0.25%	32.5	0.20% for bars not > than 16mm diameter
Walls - Vertical Reinforcement	0.15%	32.5	0.12% for bars not > than 16mm diameter

C. Serviceability Checks: The Clause 23.2 Of IS 456: 2000 States That, 'The Deflection Of The Structure Or Part There Of Shall Not Adversely Affect The Appearance Or Efficiency Of The Structure Or Finishes Or Partitions.

Type of Member	Deflection to be considered	Deflection Limitation
Supports of floors, roofs and all other horizontal members	The final deflection due to all loads including the effects of temperature, creep and shrinkage	L/250
Supports of floors, roofs and all other horizontal members	The deflection including the effects of temperature creep and shrinkage occurring after erection of partitions and the application of finishes.	L/350 or 20mm (whichever is less)

D. Lateral Sway: As Per Clause 20.5 Of IS 456:2000, Permissible Lateral Sway At Top Of The Structure Due To Transient Wind Load Is To Be Limited To H/500, Where H Is Height Of The Structure.

Storey Drift In Any Storey Under Seismic Load Is To Be Limited To Hs/250, Where Hs Is Height Of The Storey, As Per Clause 7.11 Of IS 1893.

E. Earthquake Loads: All Buildings Have Special One Direction Shear Wall Portal Frame With Long Shear Walls In Other Direction To Resist Lateral Force Due To Earthquake. Either Seismic Coefficient Method Or Response Spectrum Method Is Used Depending On The Building Height And Geometric Configuration As Specified In Clause 7.8.1 Of IS 1893.

Zone III (Zone Factor, Z = 0.16)

Importance Factor, I = 1

Soil Type = II (Medium Soil – Silty Clay with N Values between 10 and 30)

Response Reduction Factor, R = 4 for Ductile Shear Walls.

Time Period, T As Per Clause 7.6.2 Of IS 1893 For In fill Walls.

Damping Value = 5% for Concrete

3. QUANTITY COMPARISON:

G + 9 Story Buildings

PER SQFT AREA	Convenient Frame	Shear wall – Flat Slab
STEEL QUANTITY (kg)	4.90	3.95
Concrete M20 M^2	0.026	0.028
Total Frame M^2	0.259	0.204
200 Fly ash M^2	0.071	0.065
100 Fly ash M^2	0.084	0.04

G + 15 Story Buildings

PER SQFT AREA	Convenient Frame	Shear wall – Flat Slab
STEEL QUANTITY (kg)	7.94	6.84
Concrete M20 M^2	0.025	0.027
Total Frame M^2	0.247	0.221
200 Fly ash M^2	0.110	0.083
100 Fly ash M^2	0.136	0.105

G + 23 Story Buildings

PER SQFT AREA	Convenient Frame	Shear wall – Flat Slab
STEEL QUANTITY (kg)	9.675	8.447
Concrete M20 M^2	0.029	0.030
Total Frame M^2	0.282	0.258
200 Fly ash M^2	0.139	0.105
100 Fly ash M^2	0.136	0.105

4. CONCLUSION:

In The Structure In Flat Slab And Shear Wall Combination Is Use Then Cost Will Be Reduced?

- G+9 Story Building in Convenient Frame (818 Rs./Sqft), And Shear wall-Flat Slab (685 Rs./Sqft). The Reduce in Cost is 16.26 (%).
- G+15 Story Building in Convenient Frame (1201 Rs./Sqft), And Shear wall-Flat Slab (993 Rs./Sqft). The Reduce in Cost is 17.32 (%).
- G+23 Story Building in Convenient Frame (1384 Rs./Sqft), And Shear wall-Flat Slab (1120Rs./Sqft). The Reduce in Cost is 19.08(%).

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